REMARKS

Claims 24 - 71 are pending in this application. By this Amendment, claims 1 - 23 are canceled and claims 24 - 71 are new. The specification is also amended to include the Abstract. No new matter is added. Prompt and favorable consideration on the merits is respectfully requested.

Should the Examiner believe that anything further would be desirable in order to place this application in even better condition for allowance, the Examiner is invited to contact the undersigned at the telephone number set forth below.

Respectfully submitted,

Hames A. Oliff

Registration No. 27,075

Julie M. Lake

Registration No. 51,156

JAO:JML

Attachment:

Abstract Marked-up copy of Substitute Specification Clean copy of Substitute Specification

Date: May 25, 2006

OLIFF & BERRIDGE, PLC P.O. Box 19928 Alexandria, Virginia 22320 Telephone: (703) 836-6400 DEPOSIT ACCOUNT USE
AUTHORIZATION
Please grant any extension
necessary for entry;
Charge any fee due to our
Deposit Account No. 15-0461

10/580531

New U.S. National Stage of PCT/EP2004/053097 Filed May 25, 2006

AP20 Rec'd PCT/PTO 25 MAY 2006

MARKED-UP COPY OF SUBSTITUTE SPECIFICATION

PCT/EP2004/053097

IAP20 Rec'd PCT/PTO 25 MAY 2006

COMPOSITE ABRASIVE BODIES

[0001]Thi	s is a U.S. National Stage of Application No. PCT/EP2004/053097, filed	
November 25, 2004,	which claims the benefit of European Patent Application	
No. 03027086.2, filed November 25, 2003. The disclosure of the prior applications is hereby		
incorporated by refer	rence herein in their entireties.	
[0002] Tec	Technical Field	
[0003] The	invention This disclosure relates to fabrication of composite abrasive	
bodies.		
[0004] Pric	or Art	
[0005] Abr	rasive products have been used for a long time for machining materials.	
Abrasive products co	onsist of, inter alia, abradant granular particles which that are fixed to a	
backing material by means of a binder.		
[0006] DE	198 53 550 C1 describes an abrasive flap disc in which abrasive grains	
are dispersed on a base bonding coat that is applied to a backing.		
[0007] US	5,722,881 describes use of epoxies for bonding abrasive flaps to an	
abrasive wheel.		
[0008] A- <u>B</u>	Epoxy adhesives have the disadvantage of epoxies is the fact that they	
either they have very	long curing times or else they must be cured by heat. As a result, long	
holding times and/or high energy costs for curing are required for efficient mass production,		
which means increased costs for the production process.		
	DESCRIPTION OF THE INVENTIONSUMMARY	
[0009] The	erefore, an-the aim of the present invention-disclosure is to provide	
composite abrasive bodies which that can be produced in such a way that avoids the		
disadvantages of the	prior art-are avoided.	
[0010] This	s disclosure provides novel composite abrasive bodies, as well as	
methods for their pre	eparation and use. It was surprisingly found that this can be accomplished	
by means of a composite abrasive body as specified by Claim 1, as well as a method for its		
fabrication as specified by Claim 18.		
[0011] The	novel composite abrasive bodies of embodiments may overcome the	
disadvantages of the	prior art by the This is achieved in particular by use of a two-component	

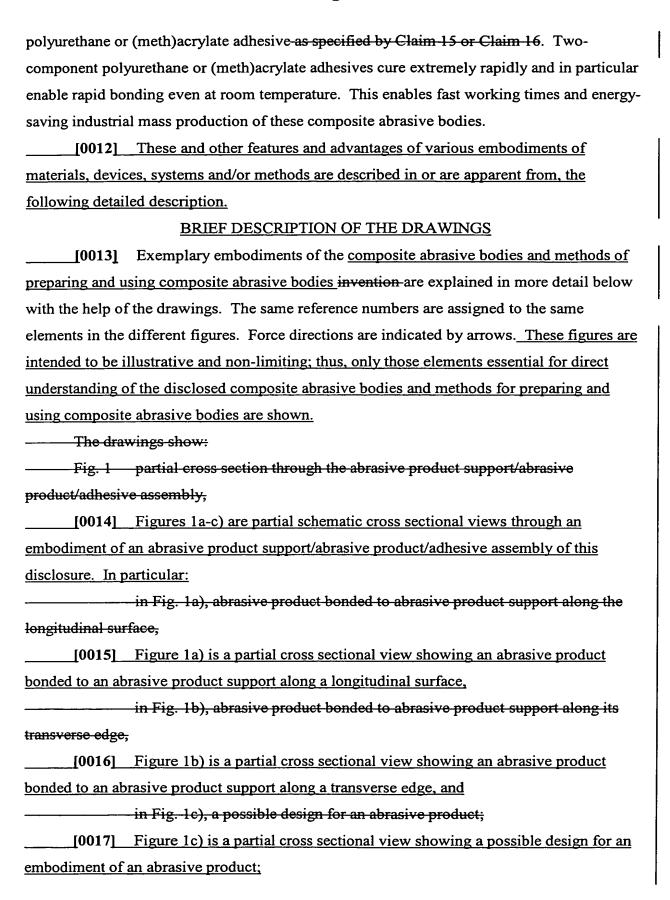
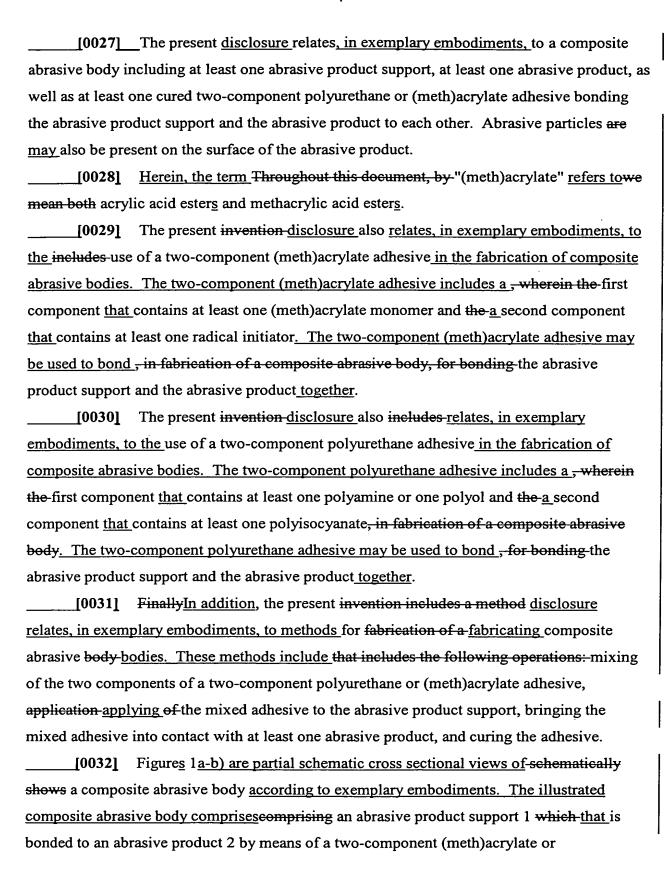
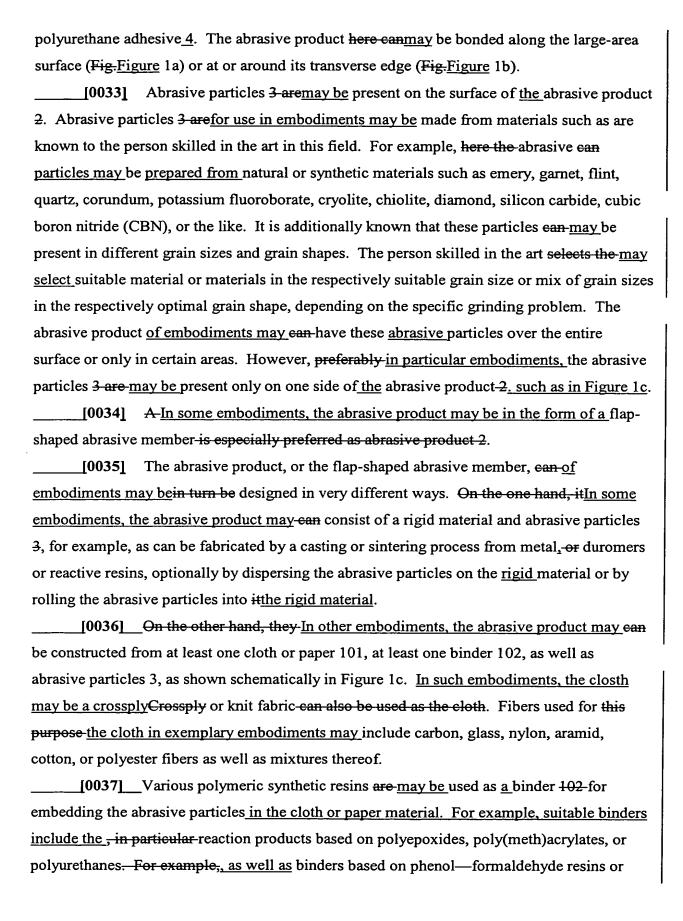
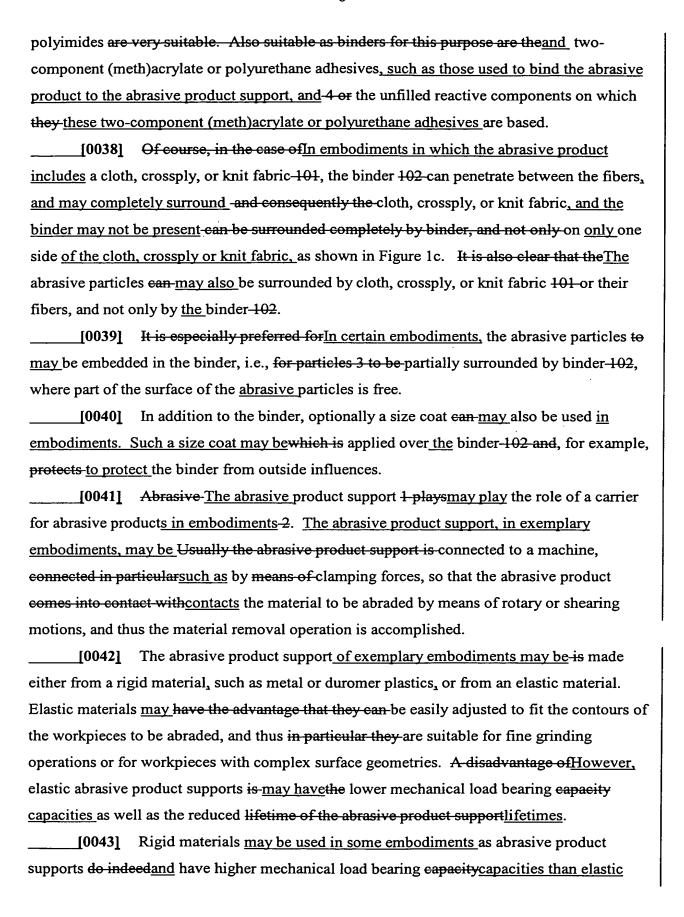


Fig. 2	view of an abrasive flap disc;	
[0018]_	Figure 2 is a schematic view of an abrasive flap disc of an embodiment of	
the disclosure.		
——Fig. 3	partial cross section through an abrasive flap disc along the line AA;	
[0019]_	Figure 3 is a partial schematic cross sectional view of the abrasive flap disc	
shown in Figure	e 2, taken along the line AA.	
——Fig. 4—	view of a grinding machine with abrasive flap disc;	
[0020]_	Figure 4 is a schematic view of a grinding machine with abrasive flap disc of	
an embodiment	of the disclosure.	
Fig. 5	view of an abrasive flap wheel;	
[0021]_	Figure 5 is a schematic view of an abrasive flap wheel of an embodiment of	
the disclosure.		
—— Fig. 6	partial cross section through an abrasive flap wheel along the line BB;	
[0022]_	Figure 6 is a partial schematic cross sectional view of the abrasive flap wheel	
shown in Fig. 5	, taken along the line BB.	
Fig. 7	view of a grinding machine with abrasive flap wheel;	
[0023]_	Figure 7 is a schematic view of a grinding machine with abrasive flap wheel	
of an embodiment of the disclosure.		
Fig. 8	partial cross section through composite abrasive body to illustrate its	
fabrication,		
[0024]_	Figures 8a) and b) are partial schematic cross sectional views through a	
composite abras	sive body to illustrate its fabrication. In particular:	
	in Fig. 8a), inserted abrasive products	
[0025]_	Figure 8a) is a partial schematic cross sectional view showing a composite	
abrasive body in	ncluding inserted abrasive products, and	
	in Fig. 8b), after the abrasive products have been tilted	
[0026]_	Figure 8b) is a partial schematic cross sectional view showing a composite	
abrasive body in	which the abrasive products have been tilted.	
	Only the elements essential for direct understanding of the invention are	
shown.		

<u>DETAILED DESCRIPTION OF EMBODIMENTS</u> <u>EMBODIMENT OF THE INVENTION</u>







materials. However, rigid materials, but they are difficult to use for grinding operations on workpieces which that have mostly non-planar surfaces.

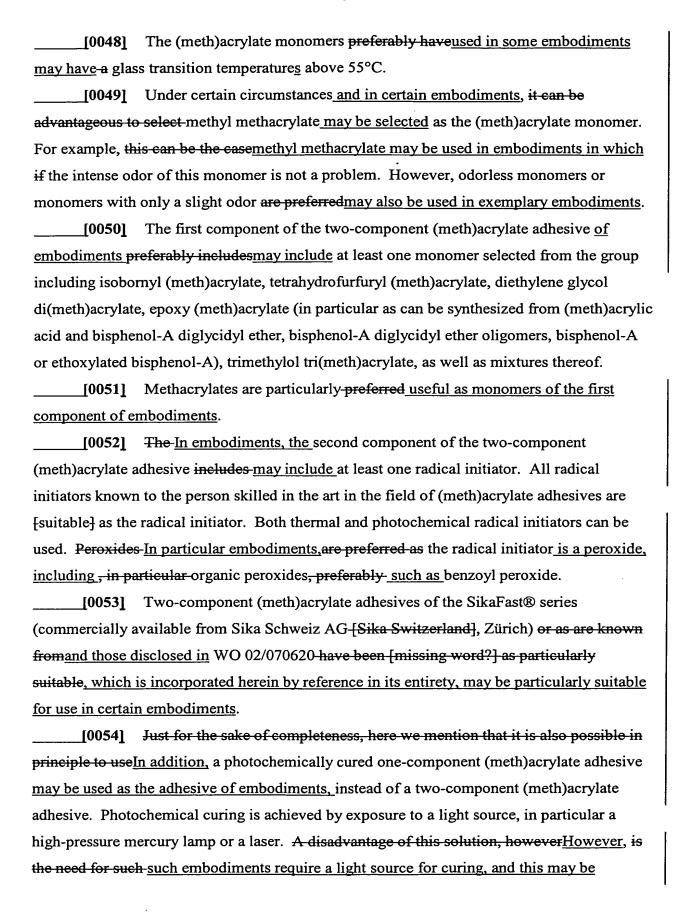
[0044] Abrasive The abrasive product support of exemplary embodiments may be 1

is preferably a circular disc, a wheel, or a belt. For this purpose, In some embodiments, the abrasive product 2 is preferablymay be bonded to the abrasive product support 1 on the largest area surface of the disc or wheel or belt, in particular such as in the radial direction of the disc or wheel.

_____[0045] Another advantageous option is for In some embodiments, the abrasive product 2 to may be bonded to the abrasive product support 1 on the peripheral surface of the wheel or circular disc, in particular such as in a radial orientation.

product 2 is in embodiments may be a two-component polyurethane or (meth)acrylate adhesive. Adhesive 4 reacts The adhesive reacts very fast even at room temperature. However, the adhesive may also be possibility that the adhesive can also be cured at higher temperatures is not ruled out. The adhesive is may be cured, in particular embodiments, at a temperature between 10°C and 180°C, in particular such as between 20°C and 80°C, preferably between 20°C and 40°C, most preferably at room temperature. However, in particular for the two-component (meth)acrylate adhesive, it is advisable for safety reasons to use higher temperatures during application and curing.

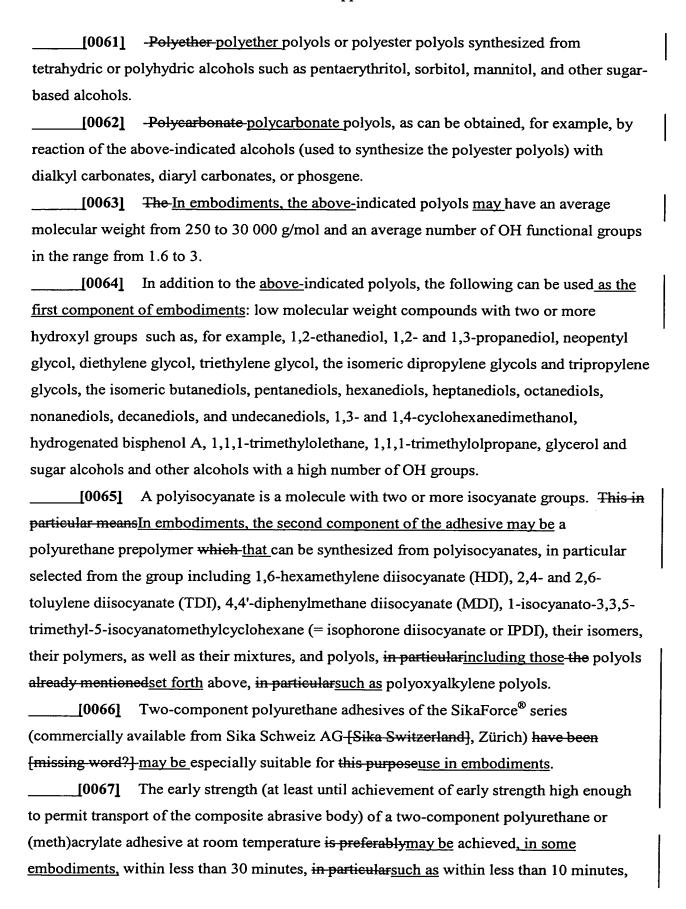
If In embodiments in which the adhesive is a two-component (meth)acrylate adhesive 4, the adhesive, the first component includes at least one (meth)acrylate monomer. Monofunctional, difunctional, trifunctional, tetrafunctional, and pentafunctional (meth)acrylate monomers are suitable. Particularly suitable (meth)acrylate monomers include methyl methacrylate, isobornyl (meth)acrylate, cyclohexyl (meth)acrylate, t-butyl (meth)acrylate, tetrahydrofurfuryl (meth)acrylate, dicyclopentadienyl (meth)acrylate, dicyclopentadienyl (meth)acrylate, dicyclopentadienyloxyethyl (meth)acrylate, ethylene glycol di(meth)acrylate, di-, tri-, tetraethylene glycol di(meth)acrylate, propylene glycol di(meth)acrylate, di-, tri-, tetrapropylene glycol di(meth)acrylate, butanediol di(meth)acrylate, hexanediol di(meth)acrylate, epoxy (meth)acrylate (in particular as can be synthesized from (meth)acrylic acid and bisphenol-A diglycidyl ether, bisphenol-A diglycidyl ether oligomers, bisphenol-A or ethoxylated bisphenol-A), trimethylol tri(meth)acrylate, pentaerythritol tetra(meth)acrylate, dipentaerythritol penta(meth)acrylate, as well as mixtures of these monomers.

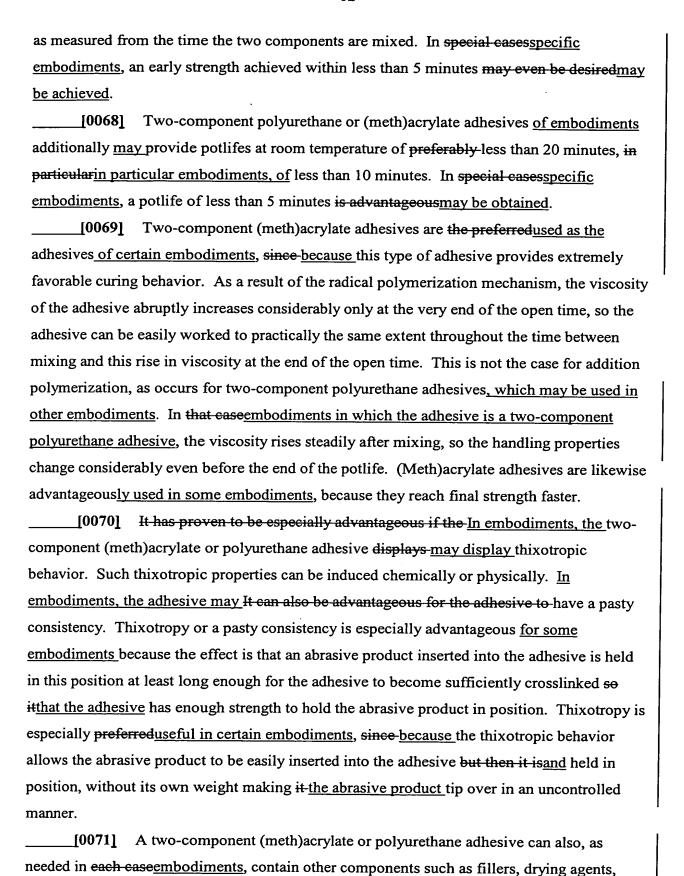


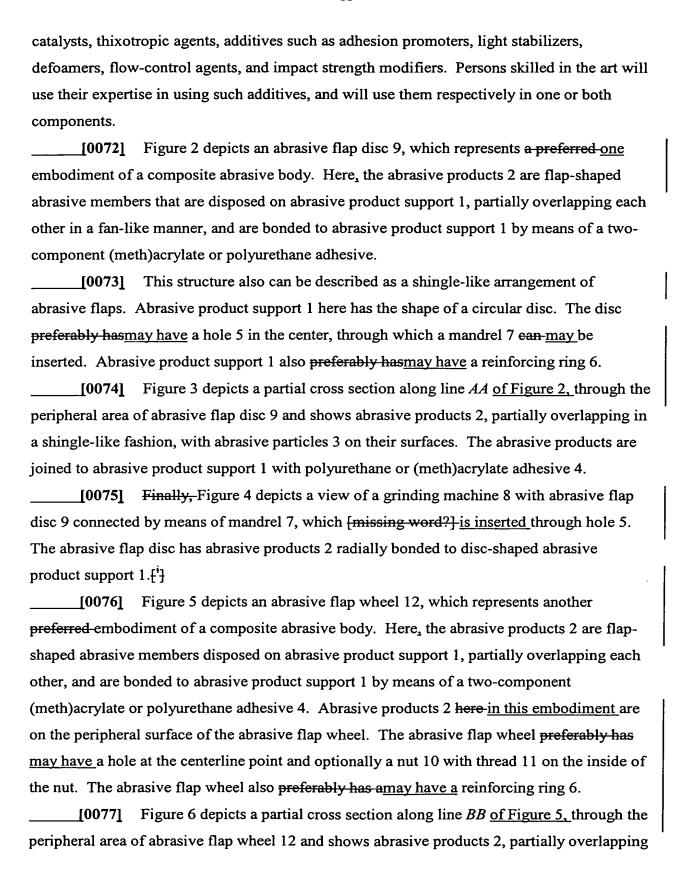
undesirable for certain embodiments in which a light source and possibly the problem that for certain embodiments according to the present invention, the adhesive area may be shaded. [0055] If-In embodiments in which the adhesive is a two-component polyurethane adhesive, the first component of the adhesive includes may include at least one polyol or one polyamine and the second component includes may include at least one polyisocyanate. A polyamine is a molecule with two or more amine functional groups, such as in particular primary amine groups. Examples of such polyamines are that may be suitable for use in embodiments are aliphatic polyamines such as ethylenediamine, 1,2- and 1,3propanediamine, 2-methyl-1,2-propanediamine, 2,2-dimethyl-1,3-propanediamine, 1,3- and 1,4-butanediamine, 1,3- and 1,5-pentanediamine, 1,6-hexanediamine, 2,2,4- and 2,4,4trimethylhexamethylenediamine and mixtures thereof, 1,7-heptanediamine, 1,8octanediamine, 4-Aminomethyl-1,8-octanediamine, 1,9-nonanediamine, 1,10-decanediamine, 1,11-undecanediamine, 1,12-dodecanediamine, methyl bis(3-aminopropyl)amine, 1,5diamino-2-methylpentane (MPMD), 1,3-diaminopentane (DAMP), 2,5-dimethyl-1,6hexamethylenediamine, cycloaliphatic polyamines such as 1,3- and 1,4-diaminocyclohexane, bis(4-aminocyclohexyl)methane, bis-(4-amino-3-methylcyclohexyl)methane, bis(4-amino-3ethylcyclohexyl)methane, bis(4-amino-3,5-dimethylcyclohexyl)methane, 1-amino-3aminomethyl-3,5,5-trimethylcyclohexane (= isophoronediamine or IPDA), 2- and 4-methyl-1,3-diaminocyclohexane and mixtures thereof, 1,3- and 1,4-bis(aminomethyl)cyclohexane, 1cyclohexylamino-3-aminopropane, 2,5(2,6)-bis(aminomethyl)bicyclo[2.2.1]heptane (NBDA, manufactured by Mitsui Chemicals), 3(4),8(9)-bis(aminomethyl)tricyclo[5.2.1.0^{2,6}]decane. 3,9-bis(3-aminopropyl)-2,4,8,10-tetraoxaspiro[5.5]undecane, 1,3- and 1,4-xylylenediamine, ether group-containing aliphatic polyamines such as bis(2-aminoethyl) ether, 4,7dioxadecane-1,10-diamine, 4,9-dioxadodecane-1,12-diamine and higher oligomers thereof, polyoxyalkylene polyamines with theoretically two or three amino groups, for example as can be obtained under the name Jeffamine[®] (manufactured by Huntsman Chemicals), aromatic amines such as, for example, 3,5-diethyl-2,4(2,6)-diaminotoluene (Lonzacure DETDA®), 3,5dimethylthiotoluylenediamine (Ethacure 300[®]), 4.4'-methylene-bis(2.6-diethylaniline) (MDEA), 4,4'-methylene-bis(3-chloro-2,6-diethylaniline) (MCDEA), as well as mixtures of the aforementioned polyamines.

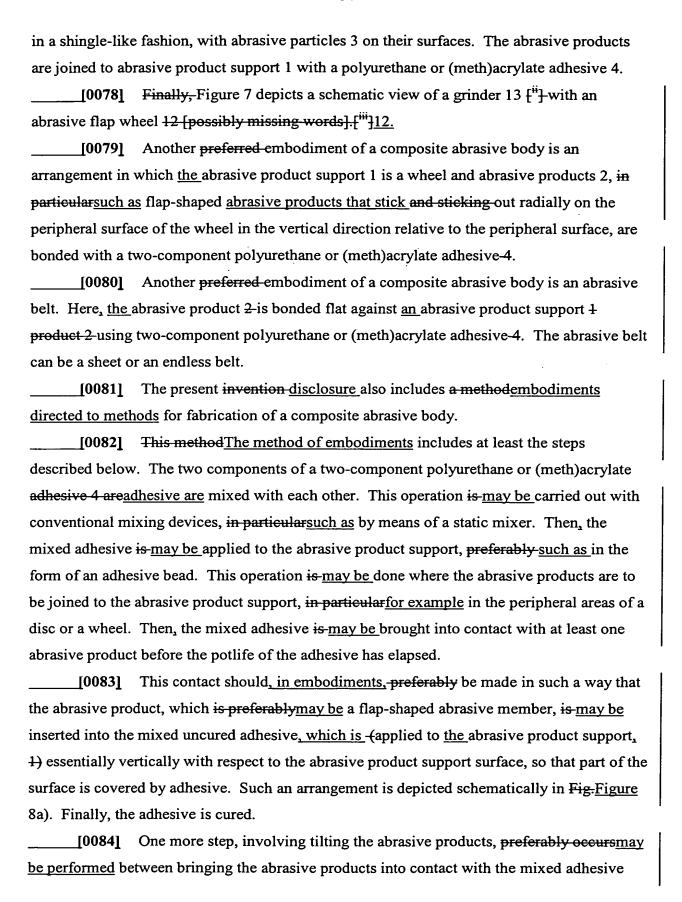
example, \(\epsilon\)-caprolactone;

[0057] A polyol is a molecule with two or more hydroxy functional groups. For example, the following commercially available polyols or any mixtures thereof can be used in exemplary embodiments: [0058] -Polyoxyalkylene-polyoxyalkylene polyols, also called polyether polyols, which are the polymerization product of ethylene oxide, 1,2-propylene oxide, 1,2- or 2,3butylene oxide, tetrahydrofuran or mixtures thereof, optionally polymerized using an initiator molecule with two or three active H atoms such as, for example, water or compounds with two or three OH groups and/or NH2 groups. Polyoxyalkylene polyols ean be used that have that may be used include those having a low degree of unsaturation (measured according to ASTM D-2849-69 and expressed in milliequivalents of unsaturation per gram polyol (meq/g)), synthesized for example using "double metal cyanide complex catalysts" (DMC catalysts for short), as well as polyoxyalkylene polyols with a higher degree of unsaturation, synthesized for example using anionic catalysts such as NaOH, KOH, or alkali metal alkoxides. Polyoxyalkylene diols and triols are especiallythat may be particularly suitable for use in embodiments are those that which have a degree of unsaturation below 0.02 meg/g and a molecular weight in the range from 1000 to 30 000 g/mol, polyoxypropylene diols and triols with a molecular weight from 400 to 8000 g/mol, as well as "EO-endcapped" (ethylene oxideendcapped) polyoxypropylene diols or triols. The latter are special polyoxypropylene polyoxyethylene polyols, that can be obtained, for example, by alkoxylating pure polyoxypropylene polyols with ethylene oxide, after completion of polypropoxylation, and thus have primary hydroxyl groups. Here and in the following, by Herein, the term "molecular weight" we always meanrefers to the average molecular weight Mw. [0059] -Polyhydroxypolyhydroxy-terminated polybutadiene polyols; [0060] -Polyester polyester polyols, synthesized for example from dihydric or trihydric alcohols such as, for example, 1,2-ethanediol, diethylene glycol, 1,2-propanediol, dipropylene glycol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, neopentyl glycol, glycerol, 1,1,1-trimethylolpropane or mixtures of the aforementioned alcohols, with organic dicarboxylic acids or their anhydrides or esters such as, for example, succinic acid, glutaric acid, adipic acid, suberic acid, sebacic acid, dodecanedicarboxylic acid, maleic acid, fumaric acid, phthalic acid, isophthalic acid, terephthalic acid, and hexahydrophthalic acid or mixtures of the aforementioned acids, as well as polyester polyols derived from lactones such as, for









and curing of the adhesive. In this waysuch embodiments, the abrasive products, inserted next to each other in the uncured adhesive, are may be taken from an essentially vertical orientation to a tilted orientation in a controlled manner. Thus a fan-like or shingle-like partial overlapping of the abrasive products 2-is achieved, as shown schematically in Figure 8. This is achieved, in particular embodiments, by means of a tangential force preferably that may be exerted on the abrasive products on the side opposite the adhesive, as is shown schematically in Figure 8a. The abrasive products are advantageously of some embodiments may be tilted only after all the abrasive products have been brought into contact with the adhesive. [0086] In the case of fabrication of an abrasive flap disc 9, this tilting of the flapshaped abrasive members is preferablymay be achieved by means of a combination rotational and pushing motion of a body touching the free edge of the upright flap-shaped abrasive members. It also can In some embodiments, it may be advantageous for the surface of the abrasive product support-1 and/or the abrasive product 2-to undergo chemical or physical pretreatment before bonding. Such pretreatment involvesmay involve, for example, grinding, brushing, sand blasting, treatment with cleaning agents, adhesion promoter solutions, or primers. This can, Such treatments may, for example, result in better adhesion and thus lead to greater safety and/or load bearing capacity of the abrasive composite. The steps of mixing, application applying, bringing into contact, and curing the adhesive may be typically are carried out at a temperature between 10°C and 180°C. usually such as between 20°C and 80°C, in particular or between 20°C and 40°C. This These steps may also be performed is preferably done at room temperature. This described The above-described method is then may be especially to be employed useful if the adhesive 4 used adhesive used exhibits thixotropic behavior and/or has a pasty consistency. List of reference numbers Abrasive product support 2 Abrasive products -3 Abrasive particles Polyurethane or (meth)acrylate adhesive 101 Cloth or paper

102	— Binder
5	Hole
6	Reinforcing ring
7	Mandrel
8	—Grinding machine
9	Abrasive flap disc
10	Nut
11	Thread
12	Abrasive flap wheel
13	Grinder